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ABSTRACT

Text, illustrations, and exercises are utilized in a set of seven learning modules to instruct nursing students in the fundamentals of drug classification, dosage, and mixing. The first module, by Dorothy Bracchi, teaches the student to identify six classifications of medication often administered to orthopedic patients: anti-neurospasmolytic agents; analgesic drugs; sedatives; antirheumatic drugs; anticholinergic drugs; and cathartics. The second module, by Miriam Eckery, discusses the effects of six antineoplastic drugs: alkylating agents; antimetabolites; hormones; natural products; radioisotopes; and miscellaneous agents. The third module, by Arvilla B. Longacre, provides exercises in the conversion of apothecary, metric, and household liquid measures. The fourth module, by Saralie Lewis, discusses insulin preparation utilizing U40, U80, and U100 syringes. The fifth module, by Janice Kinman, details techniques for mixing two parenteral drugs in the same syringe and examines situations in which such mixing is appropriate. The sixth module, by Sarah Lambert, examines drug dosage problems involving the conversion of grams and milligrams. The seventh module, by Patricia Tillman, discusses the use of proportions in drug dosage problems. The modules, which take from 20 to 45 minutes to complete, provide reinforcement exercises and immediate feedback as well as post-tests and accompanying answer keys. (JP)

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HEALTH INSTRUCTION PACKAGES

DRUG DOSAGE, CLASSIFICATION, AND MIXING

Modules prepared by:

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INTRODUCTION TO DRUGS

FOR THE ORTHOPEDIC PATIENT

By

Dorothy P. Bracchi

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TITLE:	Drugs for Orthopedic Patients
AUTHOR:	Dorothy Bracchi
INSTITUTION:	Sacramento City College, Sacramento, California
INTENDED STUDENTS:	1st Semester Nursing ADN program
ESTIMATED WORKING TIME:	20 minutes
MATERIALS NEEDED:	None
REVISED:	November 15, 1977

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INTRODUCTION

The study of pharmacology is complex and arduous for most students. For nursing students this is no exception. Generally the study of drugs in nursing school today coincides with the study of pathophysiology (which occurs after a completion of a basic course in anatomy and physiology).

This unit of study introduces students for the first time to drug classification. It is a portion of the study of the first medical/surgical condition in their first semester curriculum. It follows a course of study of fundamental nursing practice skills. The students may or may not have completed their studies of anatomy and physiology.

Future units will include teaching students some implications for nursing actions concerning medications, i.e., assessing for side effects, drug interactions and contraindications which will be indicated on cards for every drug which a student will administer to patients.

OVERALL OBJECTIVE:

The student will learn six classifications of medications, and a drug from each, which are most often administered to patients who present orthopedic problems.

SUB-OBJECTIVES:

You will be able to identify the following:

1. Anti-neurospasmolytic agents
2. Analgesic drugs
3. Sedatives and antianxiety drugs
4. Antirheumatic drugs
5. Anticholinergic drugs
6. Cathartics

You will also be able to name one drug from each of the above classifications using both the generic and proprietary names and give their correct dosage and methods of administration.

Upon completion of this unit you will be comfortable in utilizing the information when administering drugs for patients with various pathophysiological conditions.

PRACTICE EXERCISE #1

Physicians prescribe a variety of drugs which are indicated for certain orthopedic problems (concerning primarily bones, muscles, joints). Generally these patients have painful spasms; they may be anxious, may have surgery, be bedfast for long periods of time in traction, and their conditions may be degenerative. The medications which they receive generally fall into specific categories. The first to be described is the neurospasmolytic drug class.

A neurospasmolytic drug such as diazepam (Valium) acts on the body by reducing responsiveness of spinal interneurons to incoming sensory impulses. This in turn prevents initiation of motor responses. In other words, this drug prevents reflex spasm. Valium can be administered in any of three preparations, orally, intramuscularly, or intravenously. The usual dose for relief of skeletal muscle spasm is 2 to 10 mg. three or four times daily. It should be decreased for geriatric patients.

PRACTICE EXERCISE #1 (cont.)

Complete the following sentences:

Diazepam or its proprietary name, _____, acts on the spinal interneurons which in turn prevents _____. The usual dosage is _____ mg. to _____mg. three or four times a day for the non-geriatric patient.

ANSWERS ON NEXT PAGE

ANSWERS:

Correct if you stated Valium, prevents muscle spasms in dosages of 2 to 10 mg. three to four times a day.

PRACTICE EXERCISE #2

In conjunction with antispasmolytic agents, drugs which specifically relieve pain are often indicated. These are classified as analgesics. They can either be potent or mild. Demerol (meperidine) and aspirin (acetylsalicylic acid) are classified as analgesics. They both relieve pain by acting on the subcortical sites of the cerebral neurons system, but do not cause unconsciousness when prescribed dosages are correctly administered. Aspirin also acts upon the hypothalmus to reduce symptoms of fever. The usual dose of aspirin, given by mouth in tablets or capsules is 0.3 to 0.6 grams every 3 to 4 hours. The most common side effect of aspirin is gastrointestinal irritation, especially if large dosages are taken.

PRACTICE EXERCISE #2 (cont.)

Complete the following:

Analgesics can be either _____ or _____ in strength. Some analgesics have anti-inflammatory effects such as _____ which reduces _____. Aspirin is called _____ acid generically. Its dosage is 0.3 to 0._____grams _____ times per day.

ANSWERS ON NEXT PAGE

ANSWERS:

Correct if you stated that analgesics are either mild or potent. Aspirin may also reduce symptoms of fever. It is generically named acetylsalicylic acid and the dosage is 0.3 to 0.6 grams 3 to 4 times per day.

PRACTICE EXERCISE #3

Patients who are in prolonged bedrest may have difficulty getting to sleep at night. They may also be anxious and worried. Drugs which have a calming effect and produce sleepfulness fall into the category of sedatives/hypnotics. They may produce sleep for either short or long periods of time. Barbiturates are a commonly used sedative for orthopedic patients. Sedative/hypnotics like analgesics affect the central nervous system by producing drowsiness and reduce restlessness. They may be habit forming if taken over a long period of time. Nurses must be aware of potential side effects if taken with other medications. Sodium pentobarbital is the generic name for Nembutol. It is given orally and is short acting. The dosage is 30, 50, and 100 mg. capsules by mouth. It is also available in suppositories, vials, ampules and elixirs. Dosages of 100 mg. at bedtime have hypnotic effects.

PRACTICE EXERCISE #3 (Cont.)

Complete the following sentences:

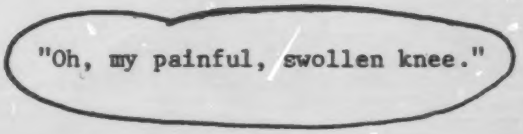
Sedatives/hypnotics are generally _____ if given over a long period of time. The usual dosage of sodium pentobarbital or _____ is usually given in doses of _____ for a hypnotic effect.

ANSWERS ON NEXT PAGE

ANSWERS:

Yes, sedatives/hypnotics are addictive or habit forming. Nembutol is usually given in doses of 100 mg. for its hypnotic effect.

PRACTICE EXERCISE #4



Rheumatoid disease is a major musculo/skeletal system disorder. Drug therapy is a specific treatment. Salicylates are the safest and most common of the anti-rheumatics. Steroids, which will not be discussed here, may also be prescribed. Rather, a drug which is neither a steroid nor a salicylate will be introduced. It is phenylbutazone, an anti-inflammatory drug which relieves symptoms only and does not affect the disease process. It is highly toxic; therefore, always given with caution. Butazolidin is a proprietary name for phenylbutazone. Its dosage is 100 mg. to 400 mg. capsules daily and is administered orally. It should be initiated by a trial period of one week to determine effectiveness, and limited to one week for patients 60 years or older.

PRACTICE EXERCISE #4 (cont.)

Complete the following:

The safest antirheumatic drug is _____.

Butazolidin or _____ may be highly _____

and must be used with extreme _____ especially in patients

who are _____ year of age.

ANSWERS:

Correct if you said that aspirin or salicylates are safest. Butazolidin or phenylbutazone may be highly toxic. It must be used with caution, especially for patients who are 60+ years of age.

PRACTICE EXERCISE #5

Patients with fractures often require surgery for the reduction of the fractures. A pre-operative medication may be a parenteral injection of an analgesic, muscle relaxant and anti-anxiety agent. Atropine sulfate is often administered to patients pre-operatively. It is an anti-cholinergic drug which acts on the autonomic nervous system. It is given as an adjunct to general anesthesia because of its hypnotic effects. It reduces the salinary and tracheobronchial secretions. It is classified as an anti-cholinergic drug because of its effects on the autonomic nervous system as a parasympatholytic agent. Its usual dosage is 0.3 to 1.2 mg. intramuscularly.

PRACTICE EXERCISE #5 (cont.)

Complete the following sentences:

A specific anticholinergic agent given pre-operatively to orthopedic patients is _____. It is administered by injection in dosages of _____ mg. to _____ mg. Because of its _____ effects, it is used pre-operatively with analgesics and a muscle relaxant.

ANSWERS:

You are correct in stating that atropine sulfate is administered pre-operatively to orthopedic patients. It is given in dosages of 0.3 to 0.6 grams. Because of its hypnotic effects, it is used pre-operatively.

PRACTICE EXERCISE #6

Without exercise, a bedfast patient can become constipated within 3 or 4 days. Cathartics as a classification include laxatives, stool softeners, and intestinal irritants. For orthopedic patients, Dulcolax is a mild irritant cathartic that may be prescribed as a preventive measure for constipation. It is a mild cathartic. It can be administered orally with results on the bowel within a few hours. It is also available in suppository forms and acts on the large intestines within minutes. Its generic name is bisacodyl.

PRACTICE EXERCISE #6 (cont.)

Complete the following:

Dulcolax or (bisacodyl) can be administered _____ or _____.

It is generally given on a _____ basis to prevent constipation. It is classified as a mild _____.

ANSWERS:

Correct if you stated Dulcolax is given orally or rectally as a suppository. It is given daily to prevent constipation and is a mild cathartic.

POST-TEST

1. Match the following:

1) A barbiturate which relieves symptoms of restlessness.	A. Antineurospasmolytic agents.
2) A muscle relaxant used in conditions of spasticity, usually a result of accident or injury.	B. Analgesic
3) A type of cathartic	C. Sedative
4) A drug which reduces pain and inflammation.	D. Antirheumatic
5) A parasympatholytic agent such as atropine sulfate.	E. Anticholinergic
6) A central nervous system depressant used to relieve pain.	F. Stool Softener

2. In each statement below, write if the statement is True or False.

1) Diazepam is the generic name for Valium. _____

2) Valium can be administered by mouth, intramuscular and intravenous routes. _____

3) 10 mg. of Valium would be a safe dose for a 76-year-old man. _____

4) Nembutol, with a dosage of 30 mg., has hypnotic effects. _____

5) Barbiturates are habit forming if taken over a long period of time. _____

6) Sodium Pentobarbital is available in capsules, I.M., and suppository forms. _____

7) Butacolidin can be safely administered to patients if monitored closely for side effects. _____

3. Multiple Choice

1) Which of the following drugs is <u>not</u> an antineurospasmolytic agent?

a. Dilantin
b. Diazepam
c. Phenylbutazone
d. Valium

Multiple Choice (cont.)

2) Which of the following is the safest and most commonly used drug for arthritis?

a. Acetylsalicylic acid
b. Valium
c. Butozolidin
d. Nembutol

3) Indicate if the information in this unit was helpful and in what way?

POST-TEST KEY

1) C
2) A
3) F
4) D
5) E
6) B

1) T
2) T
3) F
4) F
5) T
6) F
7) F

1) C
2) A
3) A

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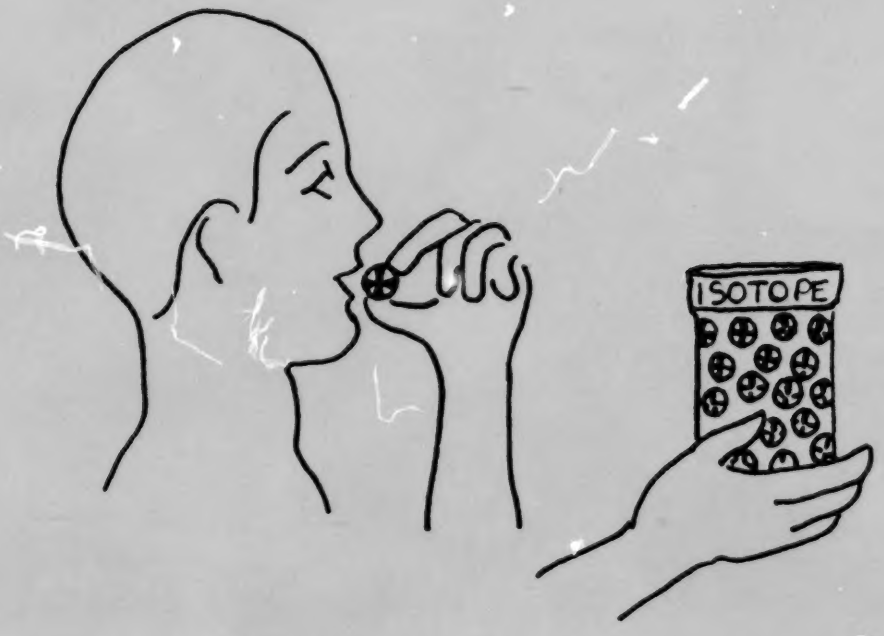
CLASSIFICATION OF ANTINEOPLASTIC DRUGS

by

Sister Miriam Eckery, CSJ, R.N.



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TITLE OF PACKAGE:	Classification of Antineoplastic Drugs
AUTHOR:	Sister Miriam Eckery, CSJ, R.N.
INSTITUTION:	St. Jude Hospital and Rehabilitation Center, Fullerton, Calif.
INTENDED STUDENTS:	Nursing (Oncology)
ESTIMATED WORKING TIME:	25 minutes
MATERIALS NEEDED:	None
REVISED:	July 1, 1977

NOTE: This is the first in a series of ten packages. Though it is prerequisite to beginning the second unit, this unit is complete, with its own objectives, and not itself dependent on any other materials.

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OBJECTIVES OF UNIT

Overall Objective

To lay the foundation for Oncology Nurses to understand the actions of the antineoplastic drugs by listing and describing the six classifications of these drugs.

Sub-Objectives

To list the six classifications of antineoplastic drugs.

To describe the action of each category of antineoplastic drugs.

To write a positive response to the self-instruction series on a simple evaluation form.

CLASSIFICATIONS OF ANTINEOPLASTIC DRUGS

Hello. Welcome to the beginning of the series on antineoplastic drugs. You will find this an exhilarating and constantly changing subject as new research is brought to light.

For our purposes, we will consider six classifications for antineoplastic drugs:

ALKYLATING AGENTS

ANTIMETABOLITES

HORMONES

NATURAL PRODUCTS

RADIOISOTOPES

MISCELLANEOUS AGENTS

Before we study each of these groups individually, memorize these six categories. When you feel you know them, turn to the next page and write them down; return to this page and see how you did.

1. Six classifications for antineoplastic drugs:

1)

2)

3)

4)

5)

6)

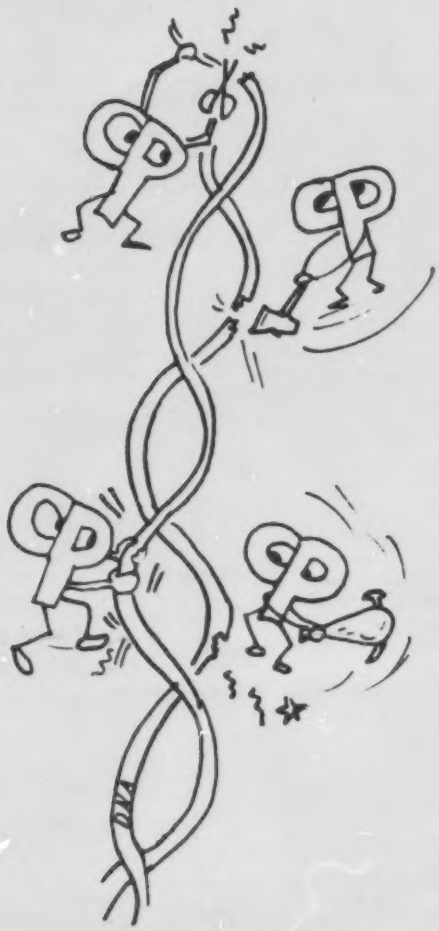
If you did not remember them all, look them over again on the preceding page. Keep trying until you can write all six.

If you did remember - fine!

Now we need an understanding of each class of antineoplastic drug. If you know how a certain group acts within the body, and you also know which drugs are in that group, then you will be able to determine the side effects to expect, and the adverse reactions to watch for.

You have written that one group of antineoplastic drugs is called ALKYLATING AGENTS. Drugs from this group attack the DNA, inhibiting cell division and multiplication. This, in turn, retards tumor growth.

Hard-working Alkylating Agents!



2. Describe the action of an <u>alkylating agent</u>. When finished, read the lower part of this page.

As long as your answer indicated that the DNA is attacked and cell division is retarded when alkylating drugs are used, then you are proceeding nicely.

Have you ever been devious? Well, antimetabolites are all the time.

ANTIMETABOLITES introduce the wrong building elements or they block synthesis of the right one. The drug acts as if it were a piece of puzzle that appears to fit on one side but, the rest of the puzzle is disrupted as it is not really the proper piece. What is disrupted or retarded in the human body is cell multiplication.

3. Now it is your turn. Without looking at the top of this page, describe how antimetabolites act within the body.

You have the right idea if you indicated that there is some type of blocking action that retards growth.

Are you ready to meet a familiar name --- HORMONES? In cancer, these drugs can be used to change the hormonal milieu of the body to a condition which is unfavorable for tumor growth. A woman may receive male hormones while the man may receive those usually reserved for the female.

4. Explain why the doctor of the woman pictured above might be prescribing male hormones for her.

Your answer is fine as long as it indicated that the doctor was probably trying to change or disrupt the normal hormonal balance.

Today we hear so much about "returning to the natural", "being natural", etc. Well, antineoplastics are going along with this trend!

Natural products, including several antibiotics too toxic for use against infections and two alkaloids derived from the periwinkle plant, have proved very useful for control of some types of cancer; e.g. Wilm's tumor.

This category appears most useful in combination with other classes of antineoplastic drugs.

Natural Products have their place. Do not close your eyes to the periwinkle plants or antibiotics!

Describe the action of Natural Products. A "catch question?" "Yes!" When it comes up on the Post-Test, just state that the classification is too broad to make an all inclusive general statement.

RADIOISOTOPES, as a class, has not maintained its former favor but it still has its uses so you must keep it on your list. A few radioactive elements are selective for certain organs. If cancer cells have infiltrated that organ, then the radioisotopes will have a greater effect on these cells because they are faster growing. The healthy cells, however, are also destroyed, but not at as great a rate. Radioisotopes act basically like the roentgen ray. They free cell-destroying ionizing radiation in the vicinity of the tumor. If there is an option, a physician might order another class of drugs in which the destruction is not as great.

5. Now go ahead and describe RADIOISOTOPES as a class. When you are ready, compare your answer with the paragraph at the top of the page.

Congratulations! You have reached the "catch-all" for all drugs that do not easily classify in any of the other groups, yet have been found helpful in treating oncology patients. The clever name this group has been given is MISCELLANEOUS AGENTS. This is another classification in which it would be difficult to describe its action.

Before you turn this page to your Post-Test, feel free to go back over any area that you wish.

Ready? Fine. Turn the page and begin.

When finished, correct your answers and then please fill out the short evaluation at the end. This is your contribution to research.

POST-TEST

1. Name the six classifications into which antineoplastic drugs are divided.

   a. _____ d. _____

   b. _____ e. _____

   c. _____ f. _____

2. Describe the action of each group of antineoplastic drugs.

   a.

   b.

   c.

   d.

   e.

   f.

POST-TEST ANSWER KEY

1. a. Alkylating Agents
   b. Antimetabolites
   c. Hormones
   d. Natural Products
   e. Radioisotopes
   f. Miscellaneous Agents

2. a. Alkylating agents are non-specific cell poisons that interfere with replication by attacking and damaging the completed DNA in the cell.

   b. Antimetabolites are chemicals that introduce the wrong building elements or block synthesis of the right ones.

   c. Hormones alter cell metabolism by changing the hormonal milieu of the body to make it unfavorable for tumor growth.

   d. Natural products such as plant alkaloids and antibiotics normally too toxic for use against infection have proved useful for control of some types of cancer. Classification basically too broad for inclusive general statement.

   e. Radioisotopes act essentially as roentgen ray does, by liberating cell-destroying ionizing radiation in the vicinity ot the tumor.

   f. Miscellaneous agents do not easily classify in any of the other groups, yet have been found helpful in treating the oncology patient.

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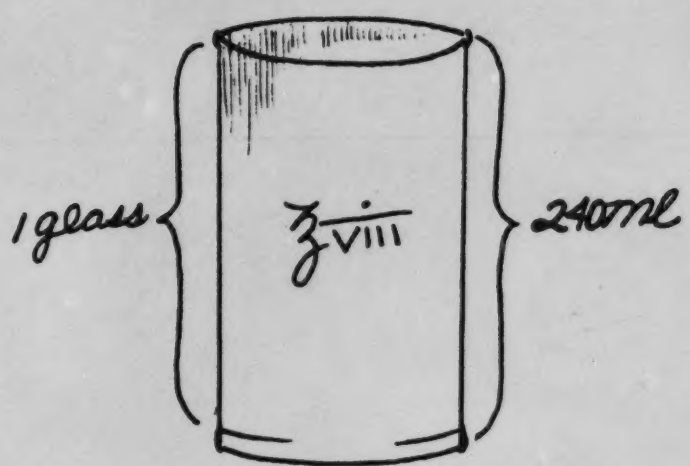
MAKE MINE METRIC

CONVERSION: APOTHECARY AND METRIC - LIQUID MEASURE

by

Arvilla B. Longacre



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TITLE OF PACKAGE:	Make Mine Metric
AUTHOR:	Arvilla B. Longacre
INSTITUTION:	Bakersfield Community College, Bakersfield, Calif.
INTENDED STUDENTS:	Nursing; other allied health
ESTIMATED WORKING TIME:	25 minutes
MATERIALS NEEDED:	Teaspoon, tablespoon; medicine glass, pint jar; milliliter syringe; pitcher of water; Elixer of Terpin Hydrate; Castor Oil: Gelusil; Milk of Magnesia; Fleets Phospho-Soda; Spiritus Frumenti.
REVISED:	May 13, 1977

NOTE: Materials listed above are needed for effective use of this unit.

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INTRODUCTION

As a nursing student, you will be pouring many oral medicines.

You will need to use three measurement systems -- Apothecary, Metric, and Household -- and will need to convert from one system to another. If you follow this self-instructional unit step by step, the learning will be easy.

OBJECTIVES OF UNIT

Overall

By the time you complete the unit, you will be able to use the enclosed conversion table to figure equivalent measurements in the three measuring systems.

Sub-Objectives

Use the conversion table.

Figure equivalent measurements.

Pour equivalent measurements.

Measure medicines correctly.

CONVERSION TABLE

Household Measure	Apothecary Measure	Metric Measure
1 teaspoon =	1 dram ($\overline{3}\dot{i}$) =	4 ml or 5 ml
1 tablespoon =	4 drams ($\overline{3}\dot{iv}$) =	15 ml or 16 ml
1 ounce ($\overline{3}\dot{i}$) =	8 drams ($\overline{3}\dot{viii}$) =	30 ml or 32 ml
1 cup =	8 ounces ($\overline{3}\dot{viii}$) =	240 ml or 250 ml
1 glass =	8 ounces ($\overline{3}\dot{viii}$) =	240 ml or 250 ml
1 pint =	16 ounces ($\overline{3}\dot{xvi}$) =	480 ml or 500 ml
1 quart =	32 ounces ($\overline{3}\dot{xxxii}$) =	960 ml or 1000 ml
1 liter =	33 ounces ($\overline{3}\dot{xxxiii}$) =	1000 ml

Look at the equipment for measuring.

Approximate Equivalents: There is a 10% error in these approximation.

(Example: $\overline{3}\dot{i}$ = 30 ml or 32 ml) See the table

Practice Question #1

Betty Jones has orders to "push fluids to 1000 ml per 8 hour shift."

This means:

_____ ml

_____ cup

_____ glasses

_____ pints

_____ quart

each 8 hour shift.

(See Feedback for answer.)

Feedback

Betty Jones should give fluids amounting to:

1000	ml
4	cups
4	glasses (1 glass = 250 cc.)
2	pints (1 pint = 500 ml)
1	quart

If you need to refer back to your chart of measures and the measures in your shoe box, do so. Then do the following problems.

Practice Question #2

You must prepare 1/2 ounce (℥ ss) milk of magnesia as a laxative. This means:

1) _____ ℥ (dram)
2) _____ ml
3) _____ teaspoon
4) _____ tablespoon
5) _____ pint
6) _____ quart

(See Feedback for answers.)

PRACTICE EXERCISE #2 (cont.)

Feedback

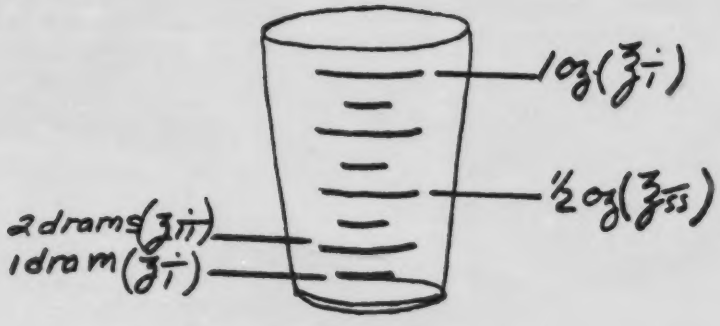
If your answers are these:

1) 4 ℥ (dram)
2) 16 ml
3) 4 teaspoon
4) 1 tablespoon
5) 1/32 pint
6) 1/64 quart

you were correct.

Look at the teaspoon, dram, and ml mark on the ounce medicine glass.

Remember: 1 dram = 1 teaspoon



Practice Question #3

Pour ʒi of Elix. of Terpin Hydrate (Cough Syrup).

This is _____ ml

_____ ʒ

Pour ʒiv of Castor Oil

This is _____ ʒ

_____ teaspoon

_____ ʒ

_____ tablespoon

_____ ml

(See Feedback for answer.)

Feedback

If you said:

4 ml

1/8 ℥ (ounce)

1/2 ℥ (ounce)

4 teaspoons

4 ʒ (dram)

1 tablespoon

16 ml

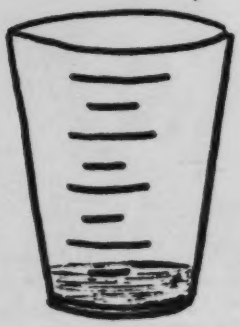
you were 100% correct!

If you need more problems, turn to the next page. Skip this next page if you can already do the problems.

Do these only if you have had difficulty with previous exercises.

Practice Question #4

Pour 1 dram (ℨ) of cough syrup in an ounce (ℨ) medicine glass.



ℨi

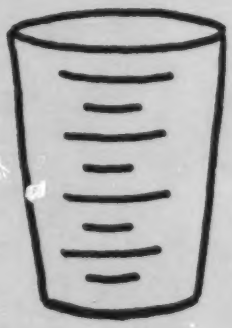
Pour ℨiv of Gelusil in an ounce medicine glass.

This is equal to _____ ℨ.

This is equal to _____ teaspoons.

This is equal to _____ drams.

This is equal to _____ ml.



(See Feedback for answers.)

Feedback

If you poured 4 ml or 1/8 ℥ you were correct.

These answers are correct: 1/2 ℥ (ounce)

4 teaspoons

4 drams

16 ml

POST-TEST

Liquid Measure

1. Pour the following measures and write equivalents in the blanks:

1 tablespoon = _____ oz. or fluidounce

1 cup = _____ oz. or fluidounce

1 pint = _____ oz.

_____ cup

_____ quart

_____ L. (liter)

2. List the following equivalents:

4 ml or 1 teaspoon = _____ ʒ or fluidram

2 ml = _____ teaspoon

4 ml or 1 teaspoon = _____ ʒ (ounce or fluidounce)

3. Pretend your pitcher holds two quarts. Work the following problems. How many?

_____ L. (liter)

_____ pint

_____ ounce

_____ ml

(See back of packet for answers)

4. You have been assigned to be the "medication nurse." Here are some of the medicines to be given. Pour them and measure correctly. Draw a picture of a medicine glass and mark your dose.

1)	milk of magnesia	(1/2 ounce)
2)	Fleets Phospho-Soda	(2 drams)
3)	Elix. Terpin Hydrate (cough syrup)	(1 dram)
4)	Spiritus Frumenti (with dinner)	(2 ounces)

ANSWER KEY TO POST-TEST

1. 1 tablespoon = 1/2 oz. or fluidounce

   1 cup = 8 oz. or fluidounce

   1 pint = 16 oz.

   2 cup

   1/2 quart

   1/2 L. (liter)

2. 4 ml. or 1 teaspoon = 1 ʒ or fluidram

   2 ml. = 1/2 teaspoon

   4 ml. or 1 teaspoon = 1/8 ʒ (ounce or fluidounce)

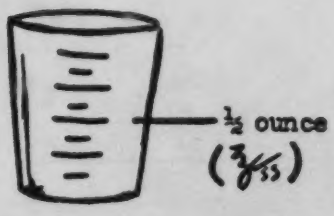
3. 2 L. (liter)

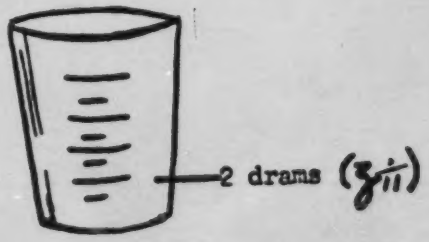
   4 pint

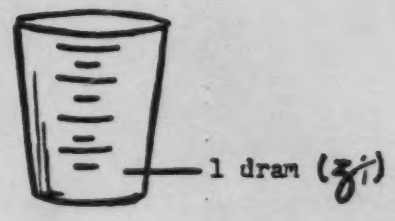
   64 ounce

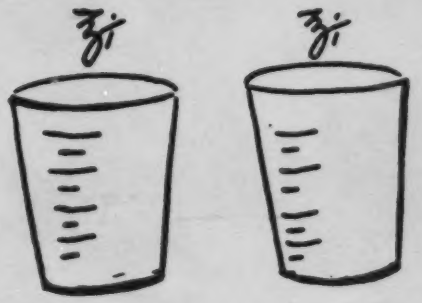
   2000 ml.

4.

1) 

2) 

3) 

4) 

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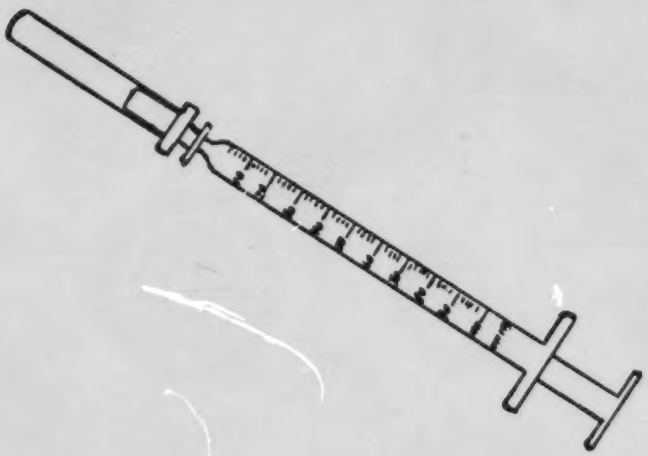
INSULIN PREPARATION USING U 40, U 80, and U 100 SYRINGES

by

SARALIE LEWIS



Saralie Lewis, 1976
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TITLE OF PACKAGE:	Insulin Preparation Using U 40, U 80 and U 100 Syringes
AUTHOR:	Saralie Lewis
INSTITUTION:	Lane Community College, Eugene, Ore.
INTENDED STUDENTS:	Nursing
ESTIMATED WORKING TIME:	25 minutes
MATERIALS NEEDED:	One Insulin syringe U 40/80, One Insulin syringe U 100, One Vial U 40 NPH Iletin, One Vial U 40 Regular Iletin, One Vial U 80 NPH Iletin, One Vial U 100 Lente Iletin, Five Alcohol Swabs
REVISED:	June 1, 1977

NOTE: Effective use of this package requires certain materials: One Insulin Syringe U 40/80; One Insulin Syringe U 100; One Vial U 40 NPH Iletin; One Vial U 40 Regular Iletin; One Vial U 80 NPH Iletin; One Vial U 100 Lente Iletin; Five Alcohol Swabs.

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INSULIN PREPARATION USING U 40, U 80 and U 100 SYRINGES

Introduction

Do you have any idea how many Americans have diabetes? There are approximately 4,000,000! Some of these people are able to control their diabetes with a regulated diet. Others take oral medication to control theirs. However, a vast number of America's diabetics require daily injections of insulin.

Since insulin is manufactured in three different strengths, it is imperative that you understand how to prepare it so that the medication and the syringe by which it is given are matched.

The purpose of this module is to teach you the three different types of insulin syringes and vials, how to ascertain which syringe to use with each vial, and how to mix two doses of the same strength insulin in one syringe.

As a prerequisite for this module, the student must have a working knowledge of the parts of the syringe and the giving of injections.

Overall Objectives

Correctly perform the precautionary checks, the drawing, and the mixing of insulin.

Sub-Objectives

1. Identify U 40, U 80, and U 100 insulin syringes.
2. Locate on the insulin vial the U 40, U 80, and U 100 indications.
3. Correlate the units on the syringe with the units on the vial.
4. Explain why an amount of air, equal to the amount of solution to be withdrawn, is injected into the vial before the medication is withdrawn.
5. Demonstrate injecting the air and withdrawing insulin from a U 80 vial.
6. Given an order for Regular Insulin 20 units with N P H Insulin 10 units (both are in U 40 vials), draw up the Regular Insulin (clear solution) into a U 40 syringe. Now draw up the additional Lente Insulin (cloudy solution) into the same syringe.
7. Commit yourself publicly to:
   a. teach patients proper technique for withdrawing insulin;
   b. assist hospital staff to practice proper technique for withdrawing insulin.

PRACTICE EXERCISE #1

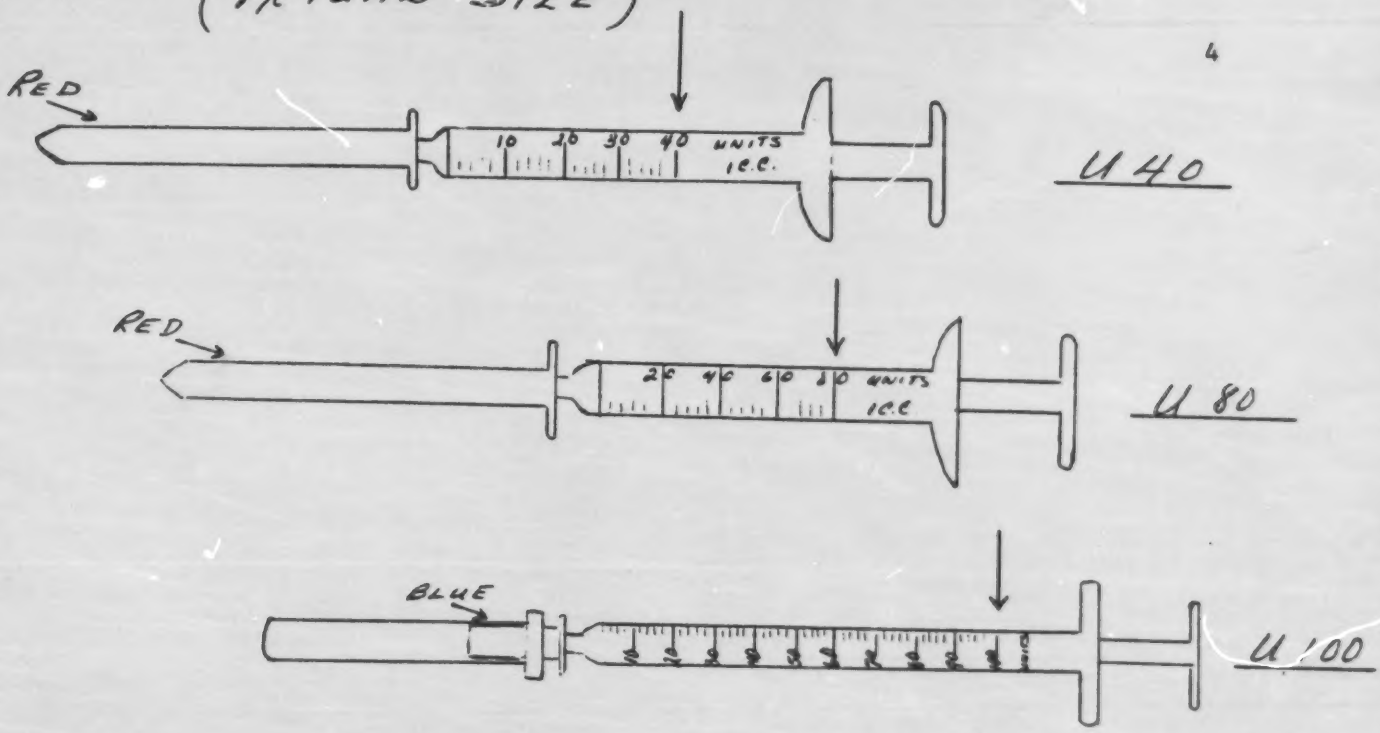
Input

You will be looking at three different types of insulin syringes: U 40, U 80, and U 100. Look at the labeled diagrams of each on Page 4. Note the arrows indicating the number of units in each syringe. By comparing the three syringes, do you see similarities and differences in the syringes? Observe that each syringe holds lcc of insulin. The variable, then, is in the strength of solution, i.e., the number of units per cc.

Sometimes the U 40 and U 80 calibrations are combined in one syringe with markings on different sides. Pick up the syringe with the red cap in front of you. Examine it to determine the difference between the U 40 and the U 80 sides. Note that on the U 40 side, the calibrations are: 10-20-30-40, while on the U 80 side they are: 20-40-60-80. This means that to draw up 10 units of U 40 insulin, your black rubber stopper would be at the same place as with 20 units of U 80. Is that right? Good! The highest number of units, then, written on the syringe indicates whether it is a U 40, U 80, or U 100 syringe. Feel free to examine the two syringes until you are comfortable with the calibrations on each.

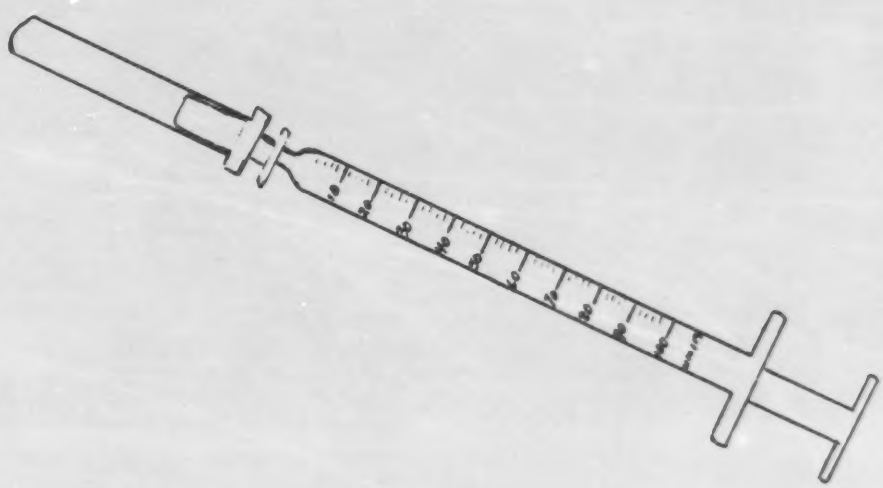
SEE P. 4 FOR DIAGRAMS ⟶

(ACTUAL SIZE)



Practice Question #1

Can you identify the following drawing as a U 40, U 80, or U 100 syringe?



Answer on p. 5

The answer to Practice Question #1: U 100

If you answered the question correctly, you are catching on quickly and may proceed to Practice Exercise #2! If you missed the question, review the Practice Exercise #1 input until it is clear.

PRACTICE EXERCISE #2

Input

Now let's move on to the 3 vials in front of you. Handle them, read the labels, and observe that each vial is clearly marked on the label as U 40, U 80, or U 100. Note that on the U 100 vial, the identification is in a slightly different location than on the U 40 or U 80 vials. Have you found these markings on each of the 3 vials? Then proceed to Practice Question #2.

Practice Question #2

Mrs. Brown's doctor has ordered 10 units of U 100 insulin for her to take daily. To verify that you are using the right strength of insulin, where on the vial will you look for the U 100 marking? You'll find the answer at the bottom on page 6.

PRACTICE EXERCISE #3

Input

Now that you understand the U 40, U 80, and U 100 markings on the syringes and the vials, you are ready to match the syringe with the vial. If the medication ordered comes in a U 40 vial, you must use the calibrations on a U 40 syringe. Pick up the U 40/U 80 syringe. Locate the 40 unit side. The calibrations on that side are the ones you will use to draw up medication from a U 40 vial. If your medication comes in a vial labeled U 80, you must use the U 80 side of the syringe. If the medication comes in a vial labeled U 100, use the U 100 syringe. Make sense? Then move on to Practice Question #3.

Practice Question #3

In giving insulin from a vial labeled U 80, which syringe will you select? The answer is at the bottom of page 7.

Did you get that one right? See, it's not as hard as you thought! Maybe you're just smarter than you thought you were!

Answer to Practice Question #2: At the top of the label.

PRACTICE EXERCISE #4

Input

Before removing any amount of medication from a vial, it is necessary to inject an equal amount of air into the vial from the syringe to displace the volume of the solution being removed. This serves to equalize the pressure within the vial.

In other words, if you are going to remove 40 units of insulin from a vial (U 40, U 80 or U 100--it doesn't matter which), you will first want to inject 40 units of air from the syringe into the vial.

Practice Question #4

Why do you inject an equal amount of air into the vial before removing the medication? The answer is at the bottom of page 8.

Is it all beginning to fall into place? Let's go on now to the real thing!

Answer to Practice Question #3: U 80 syringe

PRACTICE EXERCISE #5

Input

Let's assume that Joe Blow's doctor has ordered 20 units of U 80 insulin for him at 7:00 a.m. You are going to prepare this for him.

First, select the vial which is labeled U 80. Holding it between the palms of your hands and parallel to the floor, roll the vial gently back and forth several times to mix the medication. The solution will appear cloudy. Now set the vial down in front of you. See the little rubber diaphragm in the center of the cap on the vial? With an alcohol swab from inside the small sterile packet on your tray, wipe off the rubber diaphragm with a circular motion.

Now pick up the syringe with the U 80 calibrations. Got the right one? O.K. Find the mark for 20 units. Remove the red cap. Pull the plunger back to the 20 unit mark. Don't be afraid to move it back and forth until you are sure it is exact.

Securing the base of the vial on the table with your left hand (if you are right-handed) and holding the syringe in your right hand, plunge the needle straight down into the center of the diaphragm. It is not necessary to go all the way to the hub. So far, so good?

Now, with the plunger, push the 20 units of air into the vial. With the syringe still in the vial, turn the vial and syringe upside down and withdraw into the empty syringe 20 units of U 80 insulin. Again, don't hesitate to move the plunger back and forth until you are sure you have the correct amount. Look at the neck of the syringe. Is there an air space

---

Answer to Practice Question #4: To equalize the pressure within the vial.

between your solution and the red part? If so, draw back another 10 or more units and then push the plunger back up to the 20 unit mark. Air space gone? Good. If not, try the last step again. Now replace the red cap over the needle, being very careful not to touch the needle against the outside of the cap.

Your insulin is ready to give!

There is no test question for Practice Exercise #5.

If you feel uncertain of any part of the withdrawing procedure, feel free to work through this section again. When you are comfortable with this practice procedure, inject the insulin back into the vial. Then withdraw 20 units of air into the syringe to equalize the pressure again. Remove the syringe from the vial and push the 20 units of air out into the atmosphere with the plunger.

If you wish additional practice, try the same procedure using the U 100 vial and the U 100 syringe. Withdraw 50 units of U 100 insulin. Refer back to the procedure if you have any questions. Don't forget to cleanse the top of the vial with alcohol! Return the medication to the vial after you are through, remembering also to withdraw air afterwards.

PRACTICE EXERCISE #6

You have reached the final practice exercise and are doing just great! What I'd like for you to do now is withdraw two doses of insulin from different vials into the same syringe. REMEMBER: The vials have to be calibrated in the same number of units per cc, and the syringe calibration must agree with the vials.

So far you have worked only with cloudy insulin. Some insulin comes in a clear solution. Pick up the two U 40 vials and observe the solutions. Do you see that one is clear and one is cloudy? If these two solutions are to be mixed, you need to know that you will get a more accurate reading if you draw up the clear insulin first.

You want to inject air into both vials to replace the amount of solution withdrawn. Since a small amount of solution may remain on the needle after withdrawal, you will not want to risk getting any of the cloudy solution into the clear vial. Are you with me so far? Therefore, you will want to inject the proper amount of air into the vial of cloudy insulin first, remove the needle, and then inject the proper amount of air into the clear vial. Both of these injections of air are done before any insulin is withdrawn.

Our order from the doctor reads: Regular Insulin 20 units with N P H insulin 10 units. Pick up your two U 40 vials and determine which is Regular and which is N P H insulin, according to the labels. Now see which is clear (Regular) and which is cloudy (NPH). Which one will you withdraw first? Right! The clear one, so set it down on your left and the cloudy one on your right. At this point, roll each vial gently back and forth in your hands as you did on Exercise #5. Cleanse the top of each vial with an alcohol swab.

Removing the needle cap from your U 40 syringe, withdraw the air to inject into the cloudy vial first. How much was that? Right! 10 units. Inject this into your N P H vial and withdraw the needle. Now you are ready to inject the Regular vial with air. That was 20 units, so pull back 20 units of air and inject into the vial.

To withdraw the insulin, remember that you are going to use the clear regular solution first. Since the pressure has already been equalized, proceed to withdraw 20 units of regular insulin into the syringe. Use the previously learned procedure to make sure you have exactly 20 units. Remove the syringe and inject it into the inverted N P H (cloudy) vial and withdraw 10 units. How much total solution should you have? If you responded "30 units," that is correct.

Compare your syringe with the drawing on the next page to be sure you have withdrawn it properly. Then return the 30 cc of solution to the cloudy vial and withdraw 30 cc of air.

You will want to use other learning units to find out more about the different types of insulin, e.g. rapid-acting (Regular, Semilente), intermediate acting (NPH, Globin), long-acting (PZI, Ultralente).

To test your memory on the material covered in this unitm please turn to the Post-Test on page 13.

SOLUTION
10
50
40 units

POST-TEST

1. List the three types of insulin syringes.
2. Where on the insulin vials do you find the indication of U 40, U 80, and U 100?
3. How can you be sure you are using the right vial with the right syringe?
4. What is the purpose of injecting an equal amount of air into the vial as the amount of solution removed?
5. Demonstrate injecting the air and withdrawing 10 units of U 80 insulin into the proper syringe.
6. Demonstrate the drawing up of two different insulin doses into the same syringe. The doctor's order reads N P H Insulin 20 units with Regular Insulin 10 units.
7. Have you found this module:

   _____ too long

   _____ too short

   _____ about right

8. List below any suggestions for constructive improvement of this module.

POST-TEST ANSWERS

1. U 40, U 80, U 100

2. Top of the label

3. The identification on the vial matches identification on the syringe (e.g., U 40 with U 40, etc.)

4. Equalize the pressure within the vial.

5. Yes, demonstration done.

6. Yes, demonstration done.

7. The author hopes you responded "about right." If not, your response will be considered in revising the unit.

8. All suggestions are appreciated and will be considered in revising the unit.

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MIXING OR MESSING: MIXING PARENTERAL DRUGS IN A SYRINGE

by

Janice Kinman

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TITLE OF PACKAGE:	Mixing or Messing: Mixing Parenteral Drugs in a Syringe
AUTHOR:	Janice Kinman
INSTITUTION:	Lane Community College, Eugene, Ore.
INTENDED STUDENTS:	Nursing
ESTIMATED WORKING TIME:	45 minutes
MATERIALS NEEDED:	A Guide to I.V. Admixture Compatibility, Medical Economics Company, Oradell, N.J.; 3 syringes with needles; Tubex syringe; extra hypodermic needle; ampule of solution; one vial "A" containing a solution of phenophthalein; several multidose vials labeled "B" and one single-dose vial labeled "1" containing a "basic" solution, e.g. NaOH or $NaHCO_3$; pre-filled Tubex cartridge containing phenophthalein; sterile alcohol swabs; 12 cc syringe with needle; 10-20 cc vial labeled "potassium chloride"; single-dose vial labeled "methicillin sodium."

FIELD TEST COPY

Four prerequisites to successful use of this learning unit are: how to use a syringe, including a Tubex syringe; how to measure medication in a syringe; how to withdraw medication from an ampule and from a vial maintaining asepsis; the maximum amount of solution that can be administered for subcutaneous and intramuscular injections. An instructor or partner is needed to check the student during the post-test.

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INTRODUCTION

As a first-year nursing student, I had the experience of having to give two intramuscular medications at the same time. I can't even recall what they were now. But I questioned whether I had to "stick" my patient twice or whether I could mix the drugs together. When I asked the R.N.s, they weren't sure and suggested I try to mix them. The patient received two injections, but only after I gained the experience of having the drugs precipitate so quickly and thoroughly when mixed, that I had to remove the syringe plunger from the barrel to empty it. It wouldn't go through the needle!

The last few years I have watched students from the clinical area struggle with their technique trying to mix two compatible drugs in the same syringe, and wondered why it was so difficult for them. I finally realized that it was because I had done nothing to help them learn to do this. I hope this unit will save you from some unnecessary struggles in the clinic area with this technique.

Overall Objective:

When you complete this unit, you will be able to mix two parenteral drugs in the same syringe.

Sub-Objectives:

1) List at least two common situations in which you can mix two or more drugs in the same syringe.

2) Determine the compatibility of two drugs before mixing them by referring to a drug compatibility list or validating with a pharmacist if a list is not available.

3) Correctly withdraw an accurate amount of medication into a syringe using an ampule and a multiple dose vial.

4) Given a single dose vial and a multiple dose vial, correctly withdraw an accurate amount of medication from each.

5) Given two multiple dose vials, withdraw an accurate amount of each medication, avoiding contamination of the medication in the multiple dose vial.

6) Given a pre-filled syringe and a multiple dose vial, measure an accurate amount of medication, avoiding contamination of the medication in the multiple dose vial.

PRACTICE EXERCISE #1

Parenteral drugs are frequently ordered to be administered at the same time. Generally, the purpose for this is to permit a smaller dose of one drug to be given because the second drug potentiates its action. Occasionally, drugs may be ordered to be given at the same time and there is no relationship between their actions. Any time two compatible drugs are to be administered at the same time and by the same route, they may be mixed together in the same syringe. The major advantage to administering the drugs in the same syringe is to eliminate multiple injections to the patient. Two, and sometimes three, drugs are frequently ordered to be given preoperatively: a pain medication is generally ordered,along with a drug to potentiate its effect, and a third drug may be ordered to help decrease respiratory secretions and increase heart rate, e.g., Demerol 50 mg, Vistaril 25 mg, Atropine 0.3 mg. Pain medications are often administered along with a second drug to potentiate its effect, e.g. Demerol 75 mg and Phenergan 25 mg.

Practice Question #1

What are two common situations in which two or more medications are mixed together in the same syringe? (See answer below.)

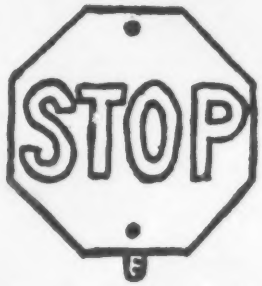
Feedback:

In order to avoid "sticking" a patient twice, two drugs that are to be given simultaneously may be administered in the same syringe, as long as the drugs are to be given by the same route and are compatible with one another. Two common situations in which this is done are (1) in the administration of two or more preoperative medications, and (2) in the administration of a pain medication and a drug to potentiate its effect.

PRACTICE EXERCISE #2

You will need the compatibility charts from "A Guide to I.V. Admixture Compatibility" before you start this exercise.

Look at the charts and notice that the drugs are listed in alphabetical order according to their generic names. Remember--if you cannot find a drug listed on an available compatibility chart, call the pharmacist to see if he has the information. If there is no pharmacist available, or there is any question



DO NOT MIX THE DRUGS!!!

Most patients would prefer to be "stuck" twice than to receive a combination of drugs that formed a precipitate or became toxic when mixed together

Wouldn't you?

Practice Question #2

a. You have orders to administer erythromycin lactobionate intravenously at 10 a.m. You also need to administer aminophyllin intravenously at 10 a.m. Can these two drugs be mixed in the same syringe? What will you do?

b. You have orders to administer meperidine hydrochloride and promethazine hydrochloride intramuscularly at the same time. Can these two drugs be mixed in the same syringe? What will you do?

Look on the next page for answers.....

Feedback #2

a. Erythromycin lactobionate and aminophyllin can be mixed together according to the chart on page 10 of the pamphlet. It is also listed on page 22 of the pamphlet. If you found this and decided it was safe to administer the two drugs together, you are on the right track in reading the compatibility charts.

b. Did you say

in response to this question?

Excellent! You could not find the drugs on the compatibility chart, so you would need to call the pharmacist. Since he is not readily available to you right now, you would not mix the two drugs. You are doing very well.

PRACTICE EXERCISE #3

On the tray in front of you are a syringe and a Tubex syringe with a pre-filled cartridge. For this practice session, pick up the ampule and vial A. Which do you think you will use first? Remember that in withdrawing a solution from a vial, you must first inject air into the vial. Does it make sense that you would first inject air into the vial, withdraw your medication from it, then withdraw your medication from the ampule? By doing this, you would not have any medication in your syringe when you inject air into the vial and would have no chance of injecting medication into the vial.

Practice Question #3

Now that you know how to do it, try mixing 0.5 cc solution from the ampule with 1 cc of solution from multiple-dose vial "A." (Remember to use aseptic technique.)

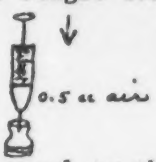
Check page 8 to see how you're doing.

Feedback #3

You probably followed this procedure:

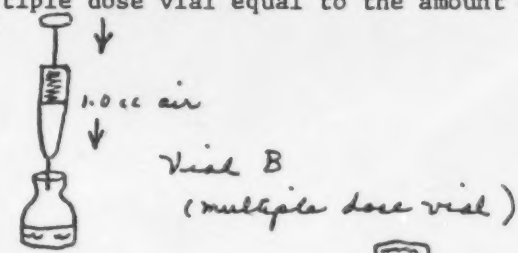
Washed your hands, swabbed the vial with alcohol, removed sheath from needle, drew 1 cc of air into your syringe, injected it into the vial and withdrew 1 cc of medication into the syringe, removed the needle from the vial and covered it with the sheath, protected the ampule neck with an alcohol swab and broke it away from your face, removed sheath from needle, withdrew 0.5 cc medication from ampule, removed the needle from the solution and covered the needle with the sheath. You are correct!

PRACTICE EXERCISE #4

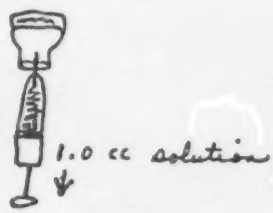
Select from the tray the single dose vial labeled "Vial 1," the multiple dose vial labeled "Vial B," and the syringe. You are going to administer these two drugs in the same syringe to a patient. Both vials need to have air added to them before withdrawing the medications, and you need to be sure that the medication in the multiple dose vial does not become contaminated by the medication from the single dose vial. What are you going to do? Think about this: If you inject a volume of air into the single dose vial equal to the amount of medication you want to withdraw; 

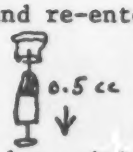
remove your needle from the vial;

inject a volume of air into the multiple dose vial equal to the amount of medication you wish to withdraw



withdraw the appropriate amount of medication from Vial B



then remove you needle from Vial B and re-enter Vial 1, withdrawing the desired amount of medication from Vial 1 

, you will have avoided any possible contamination of the multiple dose vial. Right??

Practice Question #4

Mix 1 cc of solution from Vial B with 1 cc of solution from Vial 1. (Remember your aseptic techniques again!)

Feedback on next page.....

Feedback #4

You are exactly right if you:

1. washed your hands (or remembered you would need to)
2. cleansed both vial stoppers with alcohol swabs
3. removed your needle sheath
4. drew 1 cc of air into the barrel of your syringe and injected it into Vial 1 (the single dose vial)
5. removed needle from Vial 1, drew 1 cc air into syringe barrel and injected it into Vial B
6. withdrew 1 cc solution from Vial B
7. removed needle from multiple dose vial and reinserted it in single dose vial
8. withdrew 1 cc solution from Vial 1 (single dose vial)
9. removed needle from solution and covered with needle sheath.

You're doing just great.

Don't give up now!!

PRACTICE EXERCISE #5

You have identified how to combine solutions from several different types of containers so far. Now let's think about the situation in which you might have to use solutions from two multiple dose vials. Whew!! You have to inject air into both vials and it might be possible to contaminate either solution if you have medication in the syringe when you enter the other vial. There must be a way! Let's give ourselves the advantage of using two needles in this situation. If you inject the appropriate amount of air into one vial, withdraw your needle, then inject air into the other and withdraw your medication, you have not contaminated either vial. But now your needle may have some drug on it, so change your needle, reenter the vial you originally injected air into and withdraw your medication.

Practice Question #5

Using two of the multiple dose vials in the tray, withdraw o.5 cc from Vial A (first) and 1 cc from Vial B. (Feedback is below.)

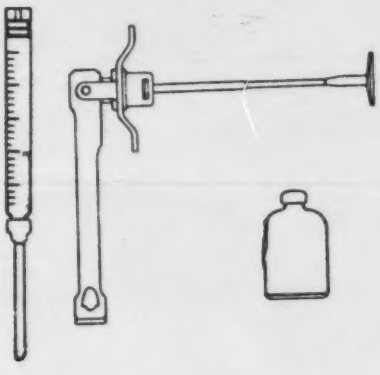
Feedback #5

It's not so terrible after all! You added 1 cc of air to Vial B, withdrew your needle; added 0.5 cc air to Vial A and withdrew 0.5 cc medication from that vial. You then withdrew your needle from Vial A, changed to a new needle, and withdrew 1 cc of medication from Vial B. Well done!

P.S. I hope you remembered your asepsis and "washed your hands" and swabbed the vial stoppers with alcohol.

Practice Exercise #6

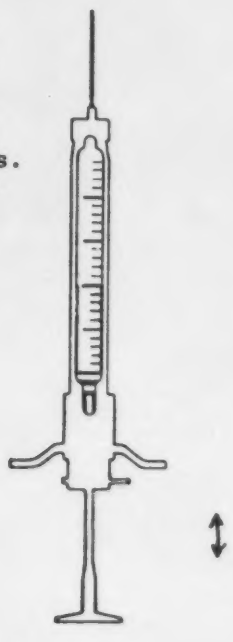
Let's consider one last situation, one in which you have a pre-filled syringe and a multiple dose vial.



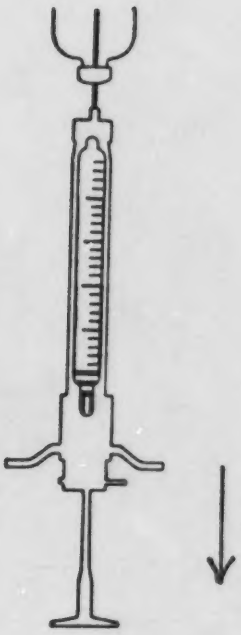
1. Wash your hands and obtain your equipment. Cleanse vial stopper with 70% alcohol.

2. Load the syringe and hold it in a vertical position -- needle up.

3. Remove the needle sheath and rotate the cartridge so you can see the calibrations. Adjust the rubber piston to the 2½ cc calibration.



4. Insert the needle into the diaphragm of the vial (after having cleansed the vial top with alcohol) and inject 1 cc of air.



5. Withdraw the plunger exactly 1 cc and remove the needle from the vial.

6. Expel the excess air and replace the sheath on the needle.

You have avoided contaminating your medication in the multiple dose vial!

Practice Question #6

Now, select the Tubex, its cartridge, and a multiple dose vial from the tray of equipment. Use 1 cc of solution in the Tubex and withdraw 1 cc solution from the multiple dose labeled "B" without contaminating the medication in the vial.

Can you do it? Check below to see if you were correct.

Feedback #6

Were you able to do it? Great! You obtained your equipment, "washed your hands," loaded the Tubex, removed the needle sheath and rotated the cartridge to see the calibrations; adjusted the rubber piston to 2½ cc, cleansed the top of the vial with alcohol, inserted the needle into the vial (while holding the Tubex vertically, needle up), injected 1 cc air into the vial, withdrew 1 cc of medication from the vial, withdrew your needle from the vial, expelled the excess air and replaced the sheath on the needle.

Practice Exercise for Overall Objective

By now you have learned to mix two parenteral drugs in a syringe by first checking the compatibility of the drug on a chart, then by using a specific technique to withdraw the solutions from the receptacles. The two drugs that are mixed must be checked for compatibility, and care must be taken to prevent contamination of a medication in a multiple dose vial. Let's try one more practice situation.

Practice Question 7

Mix 1 cc of methicillin sodium (in single dose vial) with 10 cc potassium chloride to be added to an IV solution.

You will find your feedback on page 16.....

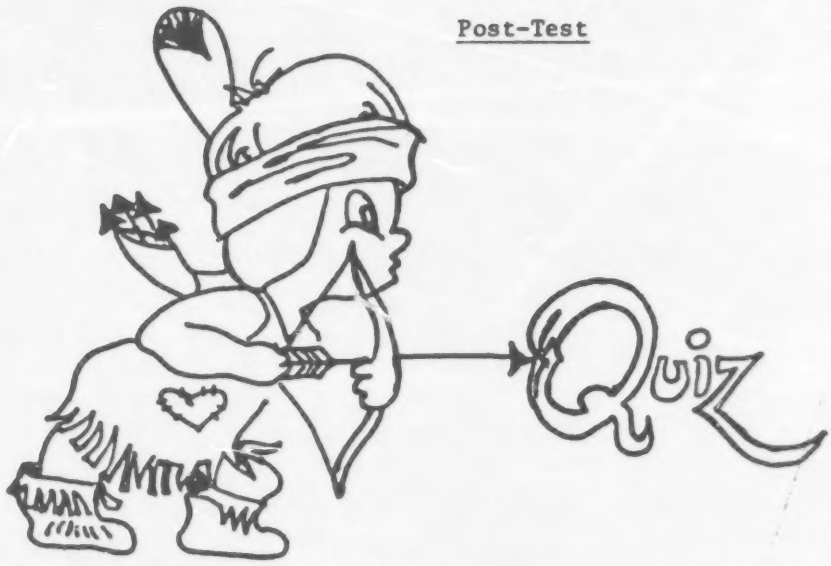
Feedback

The compatibility chart on page 34 or 35 of the pamphlet tells that these two drugs can be mixed. You would wash your hands, swab both vials with an alcohol swab, remove the needle sheath; draw 1 cc air into the syringe barrel, then inject it into the methicillin vial; remove the needle from the methicillin vial, draw 10 cc air into the syringe, inject into potassium chloride bottle and withdraw 10 cc potassium chloride; withdraw needle and reinsert into methicillin sodium bottle and withdraw exactly 1 cc solution; remove needle and cover with needle sheath.

Hooray! You have done it!

You mean I made it?

Post-Test



(Please obtain a second person who has successfully completed the unit or an instructor to check you on questions 3, 4, 5, and 6.)

1. List two situations in which two or more parenteral drugs are mixed in the same syringe.

2. Using the compatibility list, determine whether multiple vitamin infusion and potassium chloride can be mixed for intravenous infusion.

3. Correctly withdraw 0.5 cc of solution from an ampule and from a multiple dose vial, checking each amount with an instructor.

4. Correctly withdraw 1 cc each from a single dose vial and from a multiple dose vial.

5. Withdraw 1 cc of solution first from multiple dose vial A and 1 cc of solution from multiple dose vial B without contaminating the medication in vial B.

6. Using the pre-filled Tubex cartridge, withdraw 0.5 cc solution from vial B without contaminating the medication in vial B.

Answer Sheet

1. a. Two or more medications are frequently given together preoperatively, e.g. a pain medication and a sedative.

   b. A pain medication is frequently mixed with another drug that will potentiate the pain medication, e.g., Demerol and Vistaril.

2. They can.

3. Check list:

	Done	Not Done
Washes hands		
Cleanses vial stopper with alcohol swab		
Removes sheath from needle		
Draws 0.5 cc air into syringe barrel		
Injects 0.5 cc air into single-dose vial		
Withdraws 0.5 cc medication from vial		
Removes needle from vial and covers needle with sheath		
Protects ampule neck with alcohol swab and breaks away from face.		
Removes sheath from needle		
Withdraws 0.5 cc medication from ampule		
Removes needle from solution and covers with needle sheath		

4. Check list:

	Done	Not Done
Washes hands		
Cleanses both vial stoppers with alcohol swabs		
Removes sheath from needle		
Draws 1 cc air into syringe barrel and injects into single dose vial		
Removes needle from single dose vial		
Draws 1 cc air into syringe barrel and injects into multiple dose vial		
Withdraws 1 cc solution from multiple dose vial		
Removes needle from multiple dose vial and inserts into single dose vial		
Withdraws 1 cc solution from single dose vial		
Removes needle from solution and covers with needle sheath.		

5. Check list:

Washes hands	
Cleanses both vial stoppers with alcohol swabs	
Removes needle sheath	
Draws 1 cc air into syringe barrel and injects into multiple dose vial B	
Removes needle from vial B, draws 1 cc air into syringe barrel and injects into multiple dose vial A	
Withdraws 1 cc medication into syringe from vial A	
Removes needle from solution and changes to new needle	
Removes needle sheath	
Reenters vial B and withdraws 1 cc solution	
Removes needle from solution and covers with needle sheath	
No contamination of solution in vial B	

6. Check list

	Done	Not Done
Washes hands		
Cleanses vial stopper with 70% alcohol		
Loads Tubex syringe and holds it in vertical position, needle up		
Removes needle sheath and rotates cartridge to see calibrations		
Adjusts the rubber piston to the 2½ cc calibration		
Inserts the needle into the diaphragm of the vial and injects 0.5 cc air		
Withdraws the plunger exactly 0.5 cc and removes the needle from the vial		
Expels the excess air and replaces the sheath on the needle		
No contamination of solution in vial B		

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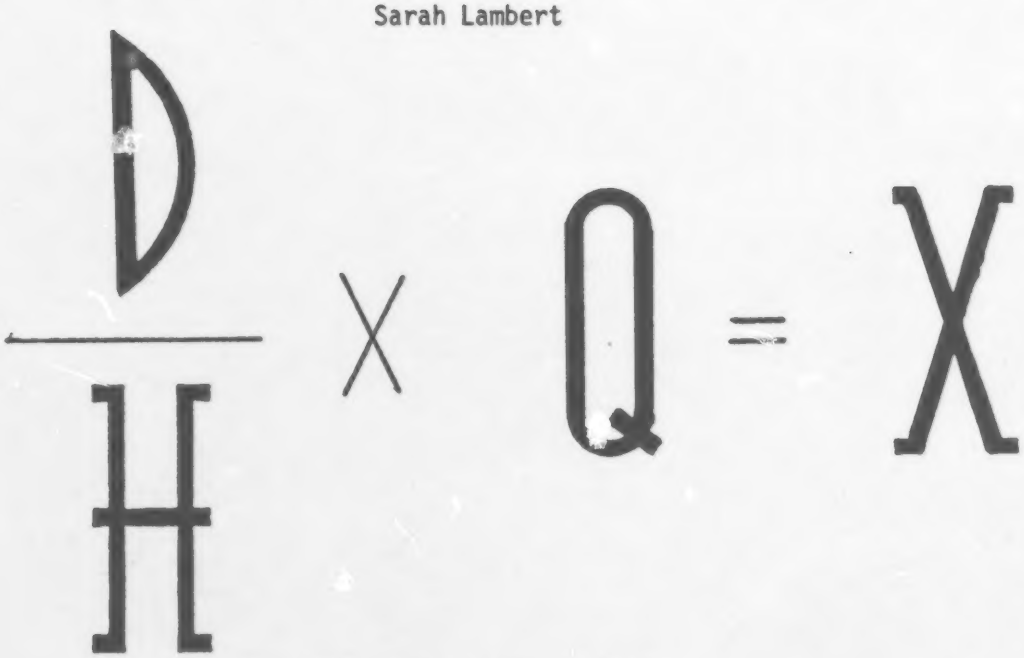
SOLVING DRUG DOSAGE PROBLEMS INVOLVING CONVERSION OF GRAMS AND MILLIGRAMS

by

Sarah Lambert



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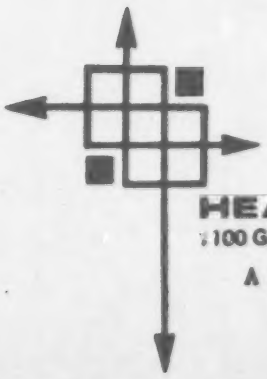
TITLE OF PACKAGE:	Solving Drug Dosage Problems Involving Conversion of Grams and Milligrams
AUTHOR:	Sarah Lambert
INSTITUTION:	Rio Hondo College, Whittier, Calif.
INTENDED STUDENTS:	Nursing
ESTIMATED WORKING TIME:	30 minutes
MATERIALS NEEDED:	None
REVISED:	June 20, 1977



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Introduction

There are two big advantages for your completing this package.

The first advantage is that it will help to make for a safe health practitioner for medications, which I know is important to you.

The second advantage is due to recent changes in hospitals' policies. Hospitals are now requiring you to take a test in Pharmacology, which includes many drug problems. If you do not pass the test, they will reduce your pay as much as $200/ month until you do pass the test.

Obviously, as your instructor, I do not want this to happen to you. Therefore, I have compiled this simple package to help you solve drug problems involving converting grams to milligrams or milligrams to grams.

Even if you never did well in math, if you follow the instruction carefully, you will succeed.

Now let's turn the page and begin.

OBJECTIVE OF UNIT

Overall Objective

Given the formula D/H x Q = X, students will be able to solve drug problems involving converting grams to milligrams and milligrams to grams.

Sub-Objectives

The student will be able to:

1. Convert grams to milligrams
2. Convert milligrams to grams
3. Fill in the formula D/H x Q = X from information contained in the drug problem.
4. Solve drug problems involving converting grams to milligrams or milligrams to grams.

Practice Exercise No. 1

You are about to learn a very simple method of converting grams to milligrams.

You already know the fact: 1 gram = 1000 mg.

To change grams to milligrams you simply multiply by 1000 because 1 gram = 1000 mg.

A fast and accurate method to multiply by 1000 is simply to move the decimal point 3 places to the right.

Remember the rule: To change grams to milligrams, move the decimal point 3 places to the right.

Now let's try an example and see how well you can do.

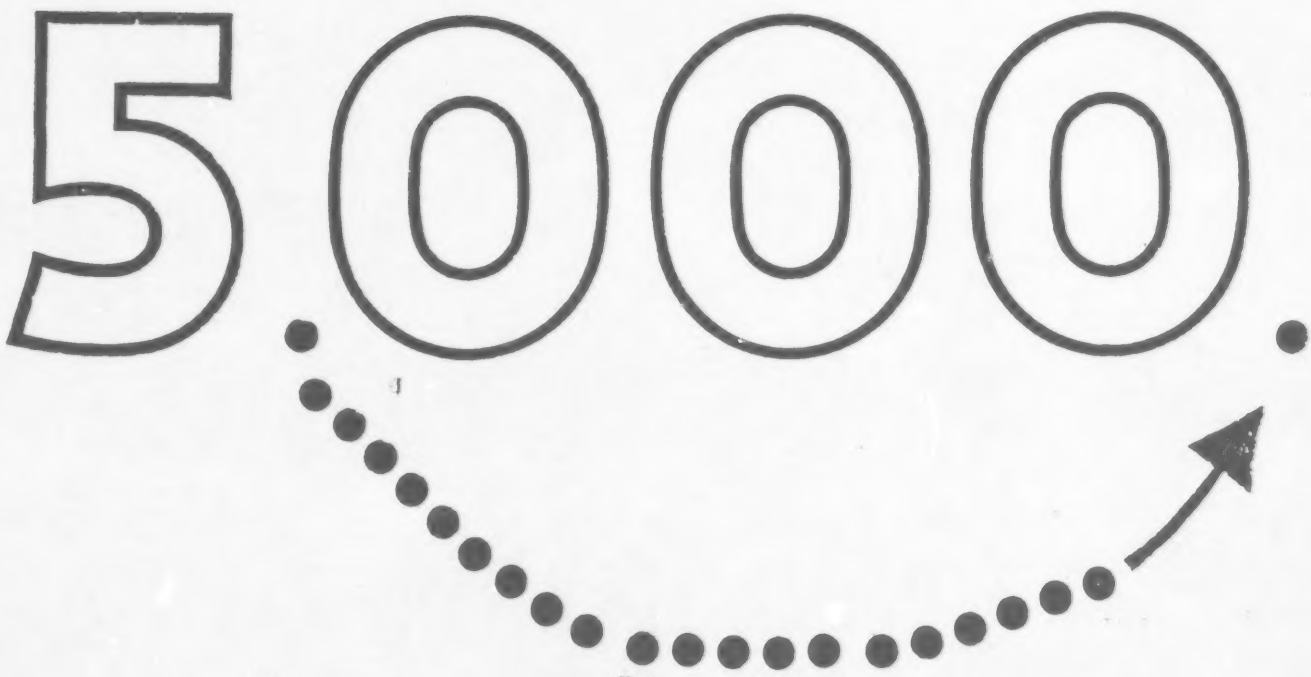
Example: 5 grams = _____ milligrams

1) Recall the rule

2) Move the decimal point 3 places to the right 5.000.

3) 5 grams = 5000 milligrams

Please turn the page for Practice Question No. 1



Practice Question No. 1

Now that you have completed Practice Exercise No. 1, let's see how well you can do the following problems.

Convert the following grams to milligrams:

1) 2 grams = _____ milligrams

2) 2.5 grams = _____ milligrams

3) 0.017 grams = _____ milligrams

Feedback

The correct answers are:

1) 2000 milligrams

2) 2500 milligrams

3) 17 milligrams

If you have the above answers, you are doing very well. You may procede to the next input on the following page.

If you have the wrong answers, don't be discouraged, you will have another chance. Re-read the input for Question No. 1.

Practice Exercise No. 2

Now that you have completed Practice Exercise No. 1, you are ready to start Exercise No. 2.

You are now going to learn a very simple method of converting milligrams to grams.

You already know the fact: 1000 mg = 1 gm.

To change milligrams to grams, you divide by 1000 because there are 1000 milligrams in 1 gram.

A fast and accurate method to divide by 1000 is simply to move the decimal point 3 places to the left.

Remember the rule: To change milligrams to grams, move the decimal point 3 places to the left.

Now let's try an example and see how well you can do.

Example: 9 milligrams = _____ grams

1) Recall the rule

2) Move the decimal point 3 places to the left .009

3) 9 milligrams = 0.009 grams.

Please turn the page for Practice Question No. 2.

Practice Question No. 2

Now that you have completed Practice Exercise No. 2, let's see how well you can do the following problems.

Convert the following milligrams to grams.

1) 0.7 milligrams = _____grams

2) 850 milligrams = _____grams

3) 75 milligrams = _____grams

Feedback

The correct answers are:

1) 0.0007 grams

2) 0.85 grams

3) 0.075 grams

If you have the above answers, you are doing just great. You may now proceede to the next input on the next page.

If you have any wrong answers, don't get discouraged, you will have another chance. Re-read the input for Question No. 2.

Practice Exercise No. 3

Now that you have successfully converted grams to milligrams and milligrams to grams, you are ready to solve actual problems involving orders given by doctors.

You will learn to solve the problem step by step so don't panic.

To solve these drug problems you will use the following formula:

$$\frac{D}{H} \times Q = X$$

Now let's look at what this formula means.

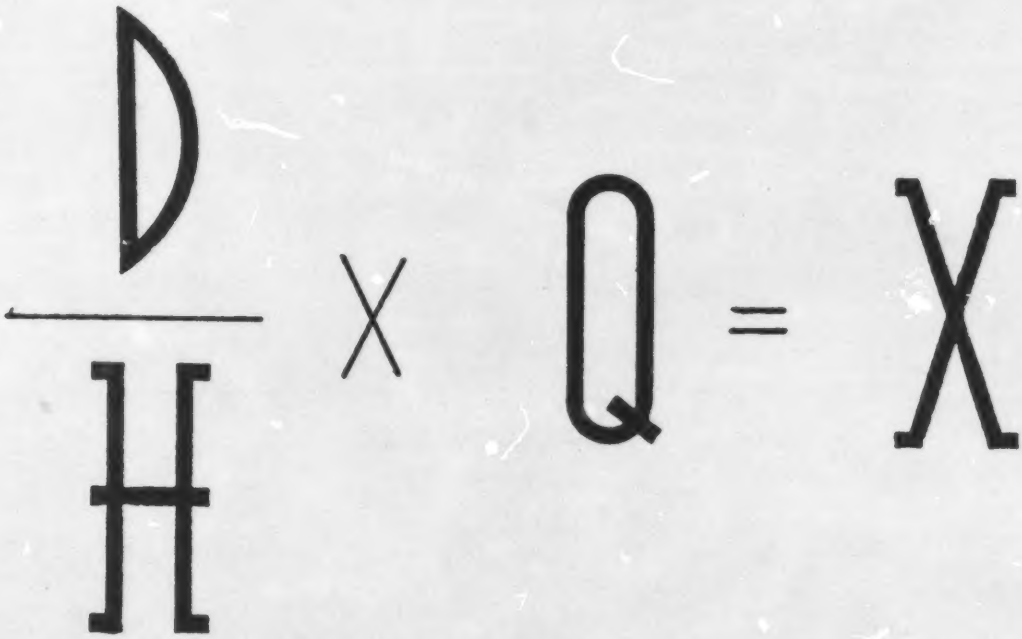
The D is for desired or the dosage you wish to give. D could also stand for "Doctor Ordered".

H is for have or the dosage strength available.

Q is for quantity or the preparation in which the drug is contained for example a tablet, cc, ounce.

X is for unknown or the amount you must give to obtain the desired dosage; for example, 1 tab, 2.5 cc.

Please turn the page for Practice Question No. 3.



Practice Question No. 3

Now let's see what you remember.

a. D is for

b. H is for

c. Q is for

d. X is for

Feedback

The correct answers are:

a. D is for desired, the dosage you wish to give, or "Doctor Ordered".

b. H is for have or the dosage strength available.

c. Q is for quantity or the preparation in which the drug is contained; for example, a tablet, cc, ounce.

d. X is for unknown or amount you must give to obtain the desire dosage; for example, 2 tab, 2.5 cc.

If you have the above answers, you are doing well. You may now proceed to the next input on the following page.

If you have a wrong answer, don't give up, you simply need to re-read your input again.

Practice Exercise No. 4

Now that you know what the formula stands for, you can now begin to solve a real problem.

Let's take an example that has been taken from a patient's chart.

The doctor ordered Polycillin 0.5 Gm. The capsules you have are labeled Polycillin 250 mg. How many capsules will you give.

First, remember the formula, $\frac{D}{H} \times Q = X$

Second, fill in the formula with the facts given in the problem.

D = (dosage you wish to give) Polycillin 0.5 Gm.

H = (the dosage strength available) Polycillin 250 mg.

Q = (Preparation in which drug contained) capsule

X = (Unknown - amount you must give to obtain desired dosage)

$\frac{D}{H} \times Q = X$ $\qquad$ $\frac{0.5 \text{ Gm.}}{250 \text{ mg.}} \times \text{capsule} = X$

Please turn the page for Practice Question No. 4.

Practice Question No. 4

Now that you have completed Practice Exercise No. 4, you will be able to fill in the drug formula for the following problems.

Given formula: $\frac{D}{H} \times Q = X$

1) The doctor orders Gantrisin 500 mg. The medication is labeled 0.5 Gm. per tablet. How many or what part of a tablet will you give?

   In the above problem:

   a. D =

   b. H =

   c. Q =

   d. X =

2) The doctor orders Achromycin .2 Gm. The medication is labeled 100 mg per tablet. How many tablets would you give?

   In the above problem:

   a. D =

   b. H =

   c. Q =

   d. X =

Please turn the page to see if you have the correct answers.

Feedback

The correct answers are:

1) a. D = 500 mg.

   b. H = 0.5 Gm.

   c. Q = tablet

   d. X = unknown or amount of desired dosage

2) a. D = 0.2 Gm.

   b. H = 100 mg

   c. Q = tablet

   d. X = unknown or amount of desired dosage

If you have the above answers, you should be really proud of yourself. You are doing just great. You may proceed to the next input on the following page.

If you have the wrong answer, don't be discouraged, you simply need to re-read the input again.

Practice Exercise No. 5

Now that you know how to fill in the formula you have only two steps to complete before you know how to complete the doctor's order.

Let's go back to our example from the patient's chart.

The doctor ordered Polycillin 0.5 Gm. The capsules you have on hand are labeled Polycillin 250 mg. How many capsules will you give?

Step 1 Fill in the formula

$$\frac{D}{H} \times Q = X \qquad \frac{0.5\ Gm}{250\ mg} \times \text{capsules} = X$$

Step 2 Check and see if D and H are in the same unit of measurement. Both Gms. or both mg. If they are not in the same unit of measurement, convert D to the same unit of measurement as H.

Example:

In the above problem D (0.5 Gm.) is not in the same unit of measurement as H (250 mg.)

Therefore, we would change 0.5 Gm. to mg.

0.5 Gm. = _____ mg.

0.5 Gm. = (500) 500 mg.

Fill your answer into the formula.

$$\frac{500\ mg.}{250\ mg.} \times \text{capsule} = X$$

Step 3 Solve the problem.

$$\frac{500\ mg.}{250\ mg.} \times \text{capsule} = X$$

$$\frac{\overset{2}{\cancel{500}\ mg.}}{\underset{1}{\cancel{250}\ mg.}} \times \text{capsule} = 2 \text{ capsules}$$

You are now ready to do Practice Question No. 5 on the following page.

Practice Question No. 5

Now that you have completed Practice Exercise No. 5 you can solve the following problems.

a. The doctor orders Gantrisin 500 mg. The medication is labeled 0.5 Gm. per tablet. How many or what part of a tablet would you give? Use formula : $\frac{D}{H} \times Q = X$

b. The doctor orders Achromycin .2 Gm. The medication is labeled 100 mg. per tablet. How many tablets would you give? Use formula: $\frac{D}{H} \times Q = X$

Please turn the page for the correct answer.

Feedback

The correct answers are: a. 1 tablet
b. 2 tablets

If you have the correct answers, you should be extremely proud. You can now solve any drug problem involving converting milligrams to grams or grams to milligrams.

If you have a wrong answer, let's see what you did wrong, so that the next time you will have 100 percent.

Step 1 Did you fill in the formula correctly?

Problem 1	Problem 2
$\frac{500 \text{ mg}}{0.5 \text{ Gm.}} \times \text{tablet} = X$	$\frac{0.2 \text{ Gm.}}{100 \text{ mg.}} \times \text{tablet} = X$

If this step is correct, let's see if you did step 2 correctly.

Did you check to see if D and H are in the same unit of measurement. Both Gms. or both milligrams. Since they are not, we have to change them so they are. We have to change D to the same unit of measurement as H.

Problem 1	Problem 2
In problem 1, we must change 500 mg to Gm.	In problem 2 we must change .2 Gm to mg.
500 mg = Gm	0.2 Gm = mg.
500 mg = (500) 0.5 Gm	0.2 Gm = (200) 200 mg.

Did you fill it into your formula correctly $\frac{D}{H} \times Q = X$

Problem 1	Problem 2
$\frac{0.5 \text{ Gm}}{0.5 \text{ Gm}} \times \text{tablet} = X$	$\frac{200 \text{ mg.}}{100 \text{ mg.}} \times \text{tablet} = X$

Now if you did the above correctly, you must have made a mistake in Step 3.

Step 3; Solve the problem.

Problem 1	Problem 2
$\frac{0.5 \text{ Gm}}{0.5 \text{ Gm}} \times \text{tablet} = 1 \text{ tablet}$	$\frac{200 \text{ mg}}{100 \text{ mg}} \times \text{tablet} = 2 \text{ tablets}$

POST-TEST

1. Convert the following grams to milligrams:

   a. 1 gram = _____ milligrams

   b. 0.5 grams = _____ milligrams

   c. 2.4 grams = _____ milligrams

2. Convert the following milligrams to grams:

   a. 7500 milligrams = _____ grams

   b. 450 milligrams = _____ grams

   c. 16 milligrams = _____ grams

3. Using the formula $\frac{D}{H} \times Q = X$, solve the following problems:

   a. The proposed daily dosage of a medication ordered is 2.5 grams. You have available 500 mg. tablets. How many tablets would you need for the daily dose?

   b. The doctor ordered Mebaral 200 milligrams. You have available Mebaral 0.2 grams. How many tablets would you give?

Please turn the page for the correct answers.

POST-TEST ANSWER KEY

1. a. 1000 milligrams
   b. 500 milligrams
   c. 2400 milligrams
2. a. 7.5 milligrams
   b. .450 milligrams or .45 milligrams
   c. 0.016 milligrams or .016 milligrams
3. a. 5 tablets
   b. 1 tablet

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HOW TO USE PROPORTIONS TO FIGURE DOSAGE PROBLEMS

by

Patricia Tillman

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TITLE OF PACKAGE:	How to Use Proportions to Figure Dosage Problems
AUTHOR:	Patricia Tillman
INSTITUTION:	Bakersfield (Calif.) College
INTENDED STUDENTS:	Nursing
ESTIMATED WORKING TIME:	40 minutes
MATERIALS NEEDED:	None
REVISED:	Nov. 30, 1977

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INTRODUCTION

You know that it is critical to the life of your patient that he receive the proper amount of medication.

One method of determining the proper amount of medication to give is to set up a proportion that relates the amount and form of medication available to the amount ordered by the doctor.

OBJECTIVES OF UNIT

Overall Objective

You will be able to work a dosage problem using proportions.

Sub-Objectives

1) Set up problem.
2) Move numbers so "x" is alone.
3) Work six dosage problems.
4) State on a scale of 1 to 10 (10 being the highest) how much confidence you have when doing dosage problems.

PRACTICE EXERCISE #1

Input

SETTING UP a problem properly is necessary for finding the correct answer. For example, if one candy bar costs 15¢, how much will 2 candy bars cost?

You know there is a relationship between the cost of 1 candy bar and the cost of 2. A method of showing this relationship is to say:

1 candy is 15¢ and 2 candies are (x) cents, ALSO

1 candy : 15 cents = 2 candy : x cents

The relationship of these numbers is written:

$$\frac{1}{15} = \frac{2}{x}$$

This is called a ratio.

To make this relationship correct, you must always have the same terms for the top numbers (such as candy) and for the bottom numbers (such as cents).

NOW TRY THIS METHOD ON ANOTHER PROBLEM.

Practice Question #1

SET UP a problem using the following information:

Do not solve for x.

One Grapefruit costs 7¢ and you want to purchase 3 Grapefruit. How much money will you need?

(See Feedback on next page for answer.)

Feedback

1 fruit : 7¢ :: 3 fruit : x cents OR 7¢ : 1 fruit = x cents : 3 fruit

AND $\frac{1}{7} = \frac{3}{x}$ OR $\frac{7}{1} = \frac{x}{3}$

If you did, go on to practice exercise #2.

If not, start over.

PRACTICE EXERCISE #2

Input

Our problem is: The doctor has ordered Aspirin grains 10 for Mrs. Iva Fever. You read the label of the medication you have and discover that one tablet equals 5 grains.

NOTE THAT THE PURPOSE OF THIS EXERCISE IS NOT TO SOLVE THE VERY SIMPLE AND OBVIOUS ANSWER, BUT TO LEARN A FORMULA THAT WILL MAKE IT EASY FOR YOU TO SOLVE, WITH PRECISE ACCURACY, OTHER MORE COMPLICATED PROBLEM SITUATIONS.

WE WILL PROCEED BY SETTING UP THE PROBLEM TO SHOW THE RELATIONSHIP BETWEEN WHAT MEDICATION WE HAVE AVAILABLE AND WHAT WAS ORDERED TO BE GIVEN TO THE PATIENT.

REMEMBER: 1 tablet is related to 5 grains the same as X number of tablets is related to 10 grains.

Another way to write this is:

---

1 tab* : 5 gr* :: x tab : 10 gr

or

5 grains : 1 tab :: 10 gr : x tab

NOTE: We must always mention the same factors:

first tablets, then grains = tablets, grains
OR
grains, tablets = grains, tablets

Practice Question #2

Your child is ill.

The doctor ordered 125 mg of cough syrup to be given. You read the label of the medication you have and discover that there are 250 mg in 4 ml. Set up the problem to show how many ml of medication you will give.

Do not solve for X. Check your answer on the next page.

*tab = tablet; gr = grains

PRACTICE EXERCISE #2 (cont)

Feedback

(Did you remember that what you have on hand is related to what you want to give?)

Did you write:

$$250 \text{ mg} : 4 \text{ ml} :: 125 \text{ mg} : x \text{ ml}$$

$$\frac{250}{4} = \frac{125}{x}$$

If yes, continue to exercise #3.

If not, return to exercise #1.

PRACTICE EXERCISE #3

Input

From Practice Question #1 we had a ratio set up for the cost of 3 grapefruit. NOW WE MUST MOVE THE NUMBERS SO THAT "X" IS ALONE.

Thus: 1 grapefruit is to 7 cents as 3 grapefruit is to x cents

$$\frac{1}{7} = \frac{3}{x}$$

Now we multiply the top number on each side of the equals sign by the bottom number on each side.

For example in the problem: $\frac{1}{7} = \frac{3}{x}$

We multiply both sides by x: $\frac{1(x)}{7} = \frac{3(x)}{x}$

$$\frac{x}{7} = \frac{3}{1}$$

Now, we multiply both sides by 7:

$$\left(\frac{7}{1}\right)\left(\frac{x}{7}\right) = \left(\frac{3}{1}\right)\left(\frac{7}{1}\right)$$

$$\frac{1x}{1} = \left(\frac{3}{1}\right)\left(\frac{7}{1}\right)$$

$$1x = 21$$

Therefore, if 1 grapefruit costs 7 cents, 3 grapefruit cost 21 cents.

Or we can solve it this way:

Divide both sides of the equation by any number in front of x, so that x will be alone.

$$\frac{1x}{1} = \frac{21}{1}$$

This is the same as saying: $x = 21$

Therefore: if 1 grapefruit costs 7 cents, 3 grapefruit will cost 21 cents.

Practice Question #3

1) Now complete the Candy Problem by solving for x.

1 candy : 5 cents :: 2 candy : x cents

(See Feedback for answer.)

2) And try this method with medication dosage from Exercise #2, the cough syrup problem.

Problem: solve for x:
250 mg. : 4 ml. = 125 mg. : x ml.

(See Feedback for answer.)

Feedback

1. Did you write: $\frac{1}{5} = \frac{2}{x}$

Did you multiply both sides by x: $\left(\frac{1}{5}\right)\left(\frac{x}{1}\right) = \left(\frac{2}{x}\right)\left(\frac{x}{1}\right)$

Did you multiply both sides by 5: $\left(\frac{5}{1}\right)\left(\frac{x}{5}\right) = \left(\frac{2}{1}\right)\left(\frac{5}{1}\right)$

$$\frac{1x}{1} = \frac{10}{1}$$

Therefore, if 1 candy bar costs 5 cents, 2 candy bars cost 10 cents.

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2. Did you set up equation: $\left(\frac{250}{4}\right) = \left(\frac{125}{x}\right)$

Did you multiply both sides by both denominators (bottom numbers):

$$\left(\frac{250}{4}\right)(x) = \frac{125}{x}(x)$$

$$4\left(\frac{250x}{4}\right) = (4)(125)$$

Did you divide both sides by 250?

$$\frac{250\,x}{250} = \frac{500}{250}$$

$$x = 2$$

Therefore, the child will receive 2 ml. of cough syrup.

You are now ready for the Post-Test.

POST-TEST

Calculate the following dosages using proportions:

1. The dose ordered is 10 mg. The tablets on hand are 30 mg.

   Give _____ tablets.

2. 80 mg of cortisone is ordered. The label reads that each ml contains 25 mg.

   How many ml will you give?

3. The dose ordered is 1.2 mg. The tablets on hand are 0.6 mg.

   Give _____ tablets.

4. The doctor ordered morphine gr 1/4. You have a vial that reads 1/6 per ml.

   Give _____ ml.

5. The order is for Benedryl 12.5 mg. The stock bottle reads 25 mg per 5 ml.

   Give _____ ml.

6. The order is for atropine gr 1/200. The ampule reads gr 1/150 per ml.

   Give _____ ml.

7. State anonymously on a scale of 1 to 10 (10 being the highest) if you feel confident and competent to work dosage problems.

   Don't understand 1 2 3 4 5 6 7 8 9 10 Confident

POST-TEST ANSWER KEY

1. $\frac{10}{x} = \frac{30}{1}$

give $\frac{1}{3}$ tablet

2. $\frac{80}{x} = \frac{25}{1}$

give 3.2 ml.

3. $\frac{1.2}{x} = \frac{0.6}{1}$

give 2 tablets

4. $\frac{1/4}{x} = \frac{1/6}{1}$

$1/4 = 1/6\ x$

$1/4 \div 1/6 = x$

$1/4 \times 6/1 = x$

Give 1.5 ml.

5. $\frac{12.5}{x} = \frac{25}{5}$

give 2.5 ml.

6. $\frac{1/200}{x} = \frac{1/150}{1}$

give 0.75 ml.

GLOSSARY

RATIO [L. computation, reason]

1. a. The indicated quotient of 2 Mathematical expressions.

   b. The relationship in quantity, amount, or size between two or more things; proportion.

2. The expression of relative values of gold and silver as determined by a country's currency values.

PROPORTION

1. The relation of one part to another or to the whole with respect to. magnitude, quantity or degree : ratio.

2. A relation of equality of two ratios in which the 1st set of four terms $\div$ 2nd = the 3rd $\div$ 4th as in $\frac{4}{2} = \frac{10}{5}$

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